

REMARKS

This paper is filed in response to the office action mailed on September 29, 2004. Claims 3-4 and 6-7 have been amended; claims 8 and 9 have been added; claims 1-9 are pending.

The office action objects to claims 4 and 6 due to an informality. In response, claims 4 and 6 have been amended to traverse this objection.

Turning to the rejections based upon the prior art, claim 1 stands rejected under 35 U.S.C. § 102(e) as allegedly being anticipated by U.S. Patent Publication 2003/0003649 ("Park"). In response, applicant presents the following remarks.

Under MPEP § 2131,

[t]o anticipate a claim, the reference must teach every element of the claim. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.

Citing, Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987).

Claim 1 recites two sequential steps that are not taught or suggested in Park. Specifically, claim 1 recites nitriding the surface of the dielectric layer with ammonia gas and then forming a metal layer containing titanium on the nitrated surface of the dielectric layer through a ALD process. Park does not teach or suggest these two steps.

The Patent Office takes the position that paragraph 0021 of Park discloses this process but, in fact, paragraph 0021 of Park clearly explains that the nitride layer 120 is formed on the surface of the substrate 100 and then, after the nitride layer 120 is formed, the dielectric layer 140 is formed on top of the nitride layer 120. See Figs. 2A-2C of Park and paragraphs 0021-0023. Then, TiN layer that serves as an upper electrode 160 is formed on the dielectric layer 140. See paragraph 0028 of Park. Therefore, Park does not teach or suggest nitriding a surface of a dielectric layer and then forming an upper layer containing titanium on the nitrated surface of the dielectric layer as recited in claim 1 and therefore Park cannot serve as an anticipating reference for claim 1.

Accordingly, applicants respectfully submit that the anticipation rejection based upon Park is improper and should be withdrawn.

Next, the office action rejects claims 1 and 3 under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,551,399 ("Sneh"). Applicant respectfully submits that this rejection is improper for the following reasons.

Under MPEP §§ 2142 and 2143,

[t]o establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and, not based on applicant's disclosure.

Citing, In re Vaeck, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991); *see also* MPEP § 2143-§ 2143.03 for decisions pertinent to each of these criteria.

Sneh does not teach or suggest the nitriding of a dielectric layer and then the forming of an upper layer containing titanium on the nitrated surface of the dielectric layer as recited in claim 1. Instead, Sneh teaches a surface activation of the dielectric layer 14 (Fig. 9). The described activation process uses $\text{NH}_3/\text{H}_2/\text{N}_2$ plasma. This is not the equivalent of nitriding the dielectric layer. In any event, Sneh then teaches the deposition of a M2 layer 15 which is tungsten or W_xN . Sneh does not teach or suggest forming an upper layer on a nitrided surface of a dielectric layer wherein the upper layer contains titanium. Therefore, Sneh does not teach or suggest numerous limitations of claim 1 and therefore Sneh cannot serve as an anticipating reference for claim 1.

Referring now to claim 3, claim 3 is directed toward a different approach. ___ part b1 of claim 3 requires the introduction of TiCl_4 gas into the chamber where the formed dielectric layer is disposed but the TiCl_4 flow rate or the feeding time is controlled to limit the exposure of the dielectric layer to TiCl_4 gas until an ALD-TiN monolayer has been formed on the dielectric layer. The cycle of titanium tetrachloride exposure and ammonia exposure is repeated as recited in dependent claim 7 to form the upper electrode.

Claim 3 cannot be anticipated by Sneh because Sneh does not teach or suggest the exposure of a dielectric layer to carefully controlled amounts of titanium tetrachloride followed by ammonia gas. Instead, Example 19 of Sneh, the example relied upon by the

Patent Office, is directed toward the ALD deposition of WN_x on a low-k dielectric layer. A combination of ammonia and hydrogen gas is used to activate the dielectric layer to leach out fluorine from the hydrocarbon of the perfluorocarbon polymer, which is the low-k dielectric layer. Then the leached surface is reacted with titanium tetrachloride followed by titanium nitride or titanium/titanium nitride ALD. The process step set forth at column 10, lines 57-60 do not match that of claim 3 and therefore Sneh does not anticipate claim 3.

In short, Sneh does not anticipate claim 1 because it does not teach a nitriding of a surface of a dielectric layer followed by forming a metal layer containing titanium on a nitrated surface of a dielectric layer.

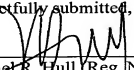
Further, Sneh does not anticipate claim 3 because it does not teach or suggest the limited exposure of a dielectric layer to titanium tetrachloride by controlling the flow or feeding time of the titanium tetrachloride until a ALD-TiN monolayer has been formed. Sneh only teaches the reaction of titanium tetrachloride with a leached perfluorocarbon polymer dielectric layer surface. Sneh teaches nothing about the controlled or limited exposure of any dielectric surface to titanium tetrachloride until a monolayer of TiN has been formed on the dielectric layer. Therefore, Sneh cannot anticipate claim 3.

The remaining amendments to the claims have been made for clarification purposes only. Applicant respectfully submits that all claims are now allowable. The amendments to claim 3 are clearly supported by the original specification and specifically at the description of Fig. 7 on pages 11-12. New claims 8 and 9 are also supported by this portion of the specification and elsewhere. Therefore, no new matter has been added by way of the amendments to the claims or new claims 8-9.

An early action indicating the allowance of claims 1-9 in this application is earnestly solicited. The Commissioner is authorized to charge any fee deficiency required by this paper, or credit any overpayment, to Deposit Account No. 13-2855.

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Respectfully submitted,

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